



A.D. 1821 N° 4539.

S P E C I F I C A T I O N

OF

HENRY PENNECK.

STEAM ENGINES, &c.

L O N D O N :

PRINTED BY GEORGE E. EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY:

PUBLISHED AT THE QUEEN'S PRINTING OFFICE, EAST HARDING STREET,
NEAR FLEET STREET.

Price 1s. 2d.

1854.



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PENNECK'S SPECIFICATION.

TO ALL TO WHOM THESE PRESENTS SHALL COME, I, HENRY PENNECK, of the Town of Penzance, in the County of Cornwall, Doctor of Physic, send greeting.

WHEREAS His most Excellent Majesty King George the Fourth, did, by His
5 Letters Patent under the Great Seal of that part of the United Kingdom of Great Britain and Ireland called England, bearing date at Westminster, the Twenty-seventh day of February, in the second year of His reign, give and grant unto me, the said Henry Penneck, my eñors, adñors, and assigns, His especial licence, full power, sole privilege and authority, that I, the said Henry Penneck,
10 my eñors, adñors, and assigns, during the term of years therein mentioned, should and lawfully might make, use, exercise, and vend, within England, Wales, and the Town of Berwick upon Tweed, and also in all His Majesty's Colonies and Plantations abroad, my Invention of "AN IMPROVEMENT OR IMPROVEMENTS OF MACHINERY FOR THE PURPOSE OF LESSENING THE CONSUMPTION OF
15 FUEL IN WORKING STEAM ENGINES;" in which said Letters Patent there is contained a proviso that if I, the said Henry Penneck, shall not particularly describe and ascertain the nature of my said Invention, and in what manner the same is to be performed, by an instrument in writing under my hand and seal, and cause the same to be inrolled in His Majesty's High Court of
20 Chancery within six calendar months next and immediately after the date of the said Letters Patent, that then the said Letters Patent, and all liberties and advantages whatsoever thereby granted, shall utterly cease, determine, and become void, as in and by the same, relation being thereunto had, will more fully and at large appear.

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NOW KNOW YE, that in compliance with the said proviso, I, the said Henry Penneck, do hereby declare that the nature of my said Invention, and the manner in which the same is to be performed, are particularly described and ascertained in and by the Drawings hereunto annexed, and the following description thereof (that is to say):—

My first improvement is applicable to the condensation of double engines, in which I use two condensers, which may have tubes passing through them, one condenser communicating with the bottom of the cylinder and with the bottom of the air pump, and the other communicating with the top of the cylinder and the top of the air pump, or vice versa. These have the usual valves, and I use an air pump with a solid piston and two discharging valves, one at the top and the other at the bottom; thus one condenser is exhausted in the ascent and the other in the descent of the air pump piston. I claim the use of the two condensers, and the keeping each in a cistern of cold water separate from the other and from the air pump, and in order that the water for condensation may be in as cold a state as possible I have a vessel in each cistern, in which the condensers are immersed, rising about an inch above the surface of the water, in which vessel the water for condensation is thrown; it also contains the common injection apparatus; thus the water is not heated by being allowed first to pass into the cistern where the condenser and air pump usually are, and by these means the condensation and vacuum of double engines will be rendered more perfect and their effect increased, and on some occasions, where the weight of the atmosphere is insufficient, I use a forcing pump, acted on by the main beam, to drive the water into the condensers, and through the tubes, if any may pass through them. And whereas a Patent was on the Thirtieth day of February, One thousand eight hundred and thirteen, granted to Robert Dunkin, of the Town of Penzance aforesaid, Gentleman, for methods of lessening the consumption of steam and fuel in working fire engines, and also methods for the improvement of certain instruments useful for mining or other purposes; and the said Robert Dunkin afterwards, in pursuance thereof, duly inrolled his Specification of such methods in the said High Court of Chancery, and has since, in consideration of several sums of money at different times, duly assigned and transferred the whole of the said Patent unto me, the said Henry Penneck, with all advantages, gains, emoluments, privileges, and profits to be derived therefrom, and by virtue thereof I became and now am the sole assignee and proprietor of the said Patent so granted to the said Robert Dunkin as aforesaid.

And whereas the said Robert Dunkin did, in and by his said Specification (among other things) describe certain machines for regulating the stroke of the

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engine as follows:—"Where the stroke of the engine begins in greater power than it terminates, which may be done by shutting off the steam at half the stroke, or otherwise;" in other words, which is commonly called working expansive, as by reference thereunto will appear; and after having described
 5 a machine to be applied to a single engine, he proceeds to describe one as applicable to a double engine in the following words:—"When I wish to regulate each stroke I apply different machines, according to circumstances. I use a lever with a single crank, with a pulley wheel fixed to the axle-tree, attached by chains to the rod, as in Fig. 1, which only goes through half a revolution and
 10 back again."

Now I have improved this machine in the manner shewn on Figure 1 hereunto annexed, which is a view of the improved machine; the same letters represent the same parts in such figures as belong to the same machine. A is the main rod of the steam engine; B is a wheel, a view and cross section of
 15 which on a larger scale are shewn at Figures 2 and 3. C is a chain fixed by a bolt on the top of the wheel B; it is passed to the right and brought round under it to be connected with the rod A by means of an iron strap projected from A to give a perpendicular haul, and fastened to A by bolts; the strap is turned up at the lower end, and has a hole passing through it to receive a bolt
 20 from C; the hole is round above and oblong below, shewn by the dotted lines in red ink; the bolt is square to allow the bur on it to be screwed tight, between which and the strap is a washer, circular on the under side for the hole to form to the vibration of the rod A. D is a similar chain, attached in like manner to the top of B, and let down to be connected with A. B has a middle
 25 rib in its periphery to prevent the chains C and D from interfering at A, is forced up and down by the motion of the engine; B will turn forth and back on the axle E, seen on a larger scale at Figure 4. F is a smaller wheel, fixed on a square on E. F is seen on a larger scale at Figures 5 and 6. E has one notch passing through its edge, which is for the catch G, which turns on a pin
 30 fastened in the raised grove in B; when G is in the notch B is connected to F, and instead of being forced by the rod A to revolve on E, it turns E with it; on each end of E a crank is placed either by being keyed or wedged; according as that part of E is round or square the cranks will be on opposite sides of B, and in opposite direction to each other. E is supported on the frame work on
 35 plummer blocks; the frame is loaded and secured down in the common manner. H, H, are sweep rods placed on each crank, and each rod has two sliding loops more than twice the length of the crank; these shoe on a pin placed across each limb of a double lever I, which has a load in its box. Figure 7 is a perpendicular view of I, with its gudgeon; if I is made of wood, it has a king post on

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each limb, supporting the anterior limb by iron straps in the usual manner; the outside straps are also brought to the after part in the common way, but the inside straps cross each other, and to allow them to do so each strap is turned half round and back again; thus they lie flat on each other, and the strap from the right king post is passed over to the left side, and the strap from 5 the left to the right side; thus are the four straps in the hinder part connected to the lever by the same pin. K is the catch regulator seen on the machine, and at Figure 8 the fork rests on the axle, and is secured to the plummer block by a limb from the washer, in the nature of a half staple, and above is attached to a cross beam by a screw and bur sliding in a groove in an iron 10 plate on the beam, and in another groove in the limb of K, to enable it to form to the proper radial line; the stem is in two parts, with sliding loops to raise or depress it as required, or, instead of being placed on the axle, it may be supported by similar grooves, plates, and screws, and fixed to two parts of the beam, so as the flanch to form concentric to the axle. To understand the use 15 of K it is necessary to know the form of the catch G, of which different views are given. Figure 9 is a side view. Figure 10, a front view of its flanch. Figure 11, a perpendicular view. In Figure 12 it is seen with the spring over it; thus the catch G being placed in one of the grooves of B, Figure 2, and the spring being rivetted to a piece of flat iron which is bent over the groove, the same pin secures 20 the spring and serves for a centre for G. K has a flanch, about an inch and half wide and seven inches long, moving on a hinge. This flanch is projected towards the wheel B, but above it; its end towards the main rod A is bevelled under, and on the other end it is bevelled over. L, L, L, is the catch lifter leading into the engine house and there connected to a handle. When the engine first begins 25 to work the vacuum is imperfect, and it is with much difficulty it will raise the load in the pumps; the lifter L is therefore drawn up, which raises the toe under the shank of the catch C, and detaches the catch from the notch in F; the wheel B then alone makes part of a revolution, and back again without acting on the axle E. By degrees, as the vacuum improves, the engine makes longer 30 and longer strokes, till the flanch of C, passing over the flanch of K, is at last carried sufficiently beyond it, when the lifter L being let down, C is forced by the spring into the notch in F, when A rising draws down the crank from the horizontal to the perpendicular line M, unwinding the chain C and winding up the chain D, and in so doing raises the load on the lever I; the motion of A 35 continuing, the crank goes on to N, the load on I subsiding, and thus winding up the chain D faster than the motion of the engine, and restoring the power it took to raise it. If the engine is acting expansive in the first part of the stroke the steam is in excess of power, and capable of raising both the load in the

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pumps and the load on the lever I, but as the steam declines in power the lever I assists the engine; this will be more clearly understood by the table constructed by the celebrated Mr. Watt, and detailed in the Encyclopedia Britannica and in Rees's Encyclopaedia, where he has shewn that the power
5 of steam decreases in proportion to the capacity of the vessels in which it is expanded, and that "if the steam valve is shut when the piston has descended quarter part down the cylinder, and the remainder of the stroke is performed by the expansion of that steam, the effect produced is more than half the effect which would have been produced by one whole cylinder full of steam if it had
10 been admitted on the piston during the whole length of the descent." When, therefore, the engine is found capable of performing its stroke, and this machine is connected by letting down the lever L, the screw must be brought down until it works easy, and hence the saving of fuel by stopping off the steam sooner from the cylinder. No particular attention will be then necessary, for whether
15 it makes a long or a short stroke the effect will be relative. The use of the flanch on K is to prevent the catch from falling before it is sufficiently over the notch to imbed itself in it; for if it should fall sooner it would have the effect of either slipping or breaking off the edge of the notch; and if by an accident it should be possible that the catch should not have entered the notch in F, but
20 after it has passed over the flanch of K should return, the flanch being moveable will rise and let it pass under. And lastly, it is necessary that the notch should be a trifle wider than the catch to allow it to enter easily under the box of the lever. I also sometimes use a spring beam. The second crank is useful to keep the notch in F perpendicular where the catch at the time of shutting off
25 and connecting must be brought, as before described. Shutting off the machine is absolutely necessary, otherwise it will not be possible to raise an equal weight in the box of the lever I, and consequently much of the effect would be lost. I sometimes use the catch and apparatus for shutting off with a single crank and common lever, with a chain instead of a sweep rod and a spring beam, and
30 allow the crank to traverse more than a hundred and eighty degrees; but some alteration will then be necessary; thus, the wheel B must be proportionably less, and the crank will be placed on the axle, suppose at 70 or 80 degrees instead of 90 from the centre of the notch in F, and if at the end of a full returning stroke the wheel B is so regulated as to have the catch perpendicular, and the spring
35 beam is placed so low as to allow the load of the lever to fall so far as to elevate the crank till the notch in the wheel F is also perpendicular, the catch will still be capable of being detached and replaced at that point. In Mr. Dunkin's aforesaid Specification he has described a machine, Fig. 2, for the same purpose as the former. I convert this into a rotary machine by subtracting the stops

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and the lever ; it will then perform a continued circular motion by the force of the engine exerted on the main rod ; but I further improve this machine. The parts in red ink represent such as cannot meet the eye on account of the opacity of other parts intervening.

Figure 13 is a side view, and Fig. 14, a front view of the machine. A is 5 the main beam, which is the same as the lever I, Figure 7, excepting that the hinder part, instead of having a box to contain the load, is connected with the piston rod in the usual manner, and that one of the limbs is longer than the other for the purpose of being connected with the two rods B and C, which are kept in a rectilineal direction by slides and grooves, shewn in red ink on the 10 Drawing, and supported by some convenient part of the building or situation where they are used, and the rods are also guided below the wheels by passing through square holes in the frame work D, D, and I use friction wheels and rollers wherever I find it necessary. B and C, by means of chains, as in Figure 1, are connected with two wheels F and G, placed on the shaft H, H, which is 15 the reason why one of the limbs of A must be longer than the other, and also that F must in the same proportion be of larger diameter than G, and as one rod is on the right of the wheels and the other on the left, it is evident that F and G will, by the up and down or reciprocating motion of the engine, be turned in opposite directions. I, I, are two other wheels, with teeth in them, 20 firmly fixed on the shaft H, H. The parts where F and G are placed must be turned perfectly cylindrical, and the centre holes of these wheels are also made to fit the shaft, and lined with brass for them to work on, while the parts where I, I, and the wheel to turn the machinery K, are fixed must be square or polygonal, or else they must be keyed to the shaft. A competent workman will 25 have no difficulty on these points. The wheels F and G are kept in such close contact with the wheels I, I, as to let them move pass each other with the least friction, and should have a small head or ring on each side of them, or any other mode commonly used to prevent or lessen friction. L is a catch which turns on a bolt or centre fixed on the wheel F, over I ; its head is between F 30 and K, and abridle similar to the main spring of a gun should support its centre, which, as well as the hole in L, and the whole bolt, except where it passes through F, where it should be square, should be perfectly cylindrical, and a washer and bur, to prevent its unscrewing, should be placed outside of the bridle. The form of the catch is shewn on Figure 14, from which it will be seen 35 that either end, if depressed, will take in the wheel I, that it has a tumbler in the centre, and is acted on by a spring M like the hammer spring in a gun lock ; thus, while the spring is acting on the right side of the centre the left limb will be depressed into the teeth of the wheel I, and yet be allowed sufficient action,

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when the motion of the wheel F is reversed, to slip over the teeth of I without the tumbler rising the spring so much as to occasion it to upset and throw down the other limb; and these circumstances must be particularly attended to in the manufacture. A similar catch and spring is placed on the other
5 side the wheel G, and secured to it in the same manner. These catches are in the same direction, but the wheels turning in opposite directions, the reciprocating force of the engine through the medium of the chains and wheels F and G is transferred to the shaft H, H, which thereby acquires a constant circular or rotary motion; and this kind of spring catch or a common
10 spring catch shewn in the Patent of the said Robert Dunkin before recited will perform all that is required if the motion is in one direction only; and I do not confine myself to the particular form or number of the teeth in the wheels I, I; what I intend to represent on the Drawing are nearly square, except that they are a little rounded towards their tops so as to take off their
15 angles, and also to have the spaces between them larger than the teeth; they will have the same effect as ratchet teeth. Plummer blocks are so generally understood to be necessary in all rotary machinery, that I have not thought it of consequence to particularize the situations where they must be applied, and those will greatly depend on the situations where the wheel which is to give
20 motion to machinery, and the fly-wheel when used may be fixed on the shaft; nor do I confine myself to the situation where the wheel which turns the machinery, which I have named K, shall be placed, nor of what kind it may be, as at one time it may be of one sort, and at another of another sort, according to the machinery with which it shall be used; but when the reverse
25 motion is to be performed, other machinery require to be brought into action, and for this purpose I do not allow any such machinery that I may apply to touch the shaft, for the wheels N, N, turn on hollow cylinders on but larger than the shaft, which cylinders are fixed in the frames O, O; these will be better understood from Figure 15, where P represents one of these hollow cylinders,
30 on which the wheels N, N, are placed; N, on a larger scale, is seen at 16. I shall confine myself to the description of one of these wheels N, as the other is exactly like it; thus the flanch on the end of P will keep N from moving towards the wheel I; the other end of the cylinder P is brought through the frame O, and through a washer, which is secured by forelocks to P, and by
35 bolts to O, thus keeping P firm and steady; both sides of N are exactly alike, and may be made of wood, and parts cut out for placing four oblong bolts in it, shewn at 17; there are holes for the bolts to pass through, but the bolts are retained by the springs *u, u*, from being thrown out of the holes back into the frame O, further than the depth of their inclined planes. These springs act

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against plates of iron, screwed on each side to N, under which plates grooves are cut, which are shewn by the lines of red ink, for the springs to move in; they also give a right direction to the bolts. The frames O, O, Figure 18, are alike; they need only plates on their sides next the wheels N, N, and parts of them should be made removeable, which should be taken off, in order to take 5 out the bolts in N, N, to repair their springs or otherwise, without taking the other parts of the machine to pieces; the pinions Q, Q, Fig. 13, are larger or smaller as required, and are fixed on a shaft R, square, except where it turns in its plummer blocks, and Q, Q, are moved by the handle S. A strong lever T on Figure 13, with a cutter edge, shewn more distinctly at 19, works on its 10 centre, attached to the beam over the wheels, Figure 13, which confines the frames together; it works in strong guides, and when its lever is raised the cutter is forced between the teeth of the wheel K, which is then prevented from moving; thus, when the reversing motion becomes necessary, the engine man stops the engine and raises the handle of the lever T, and forces the cutter 15 out of its strong guide, seen above the wheel K, into the teeth of the wheel K, or thrusts a bolt conducted in strong guides, if that is used instead of T between the spokes of K, which will prevent the machinery moving whilst he turns the pinions Q, Q, by the handle S. These move the wheels N, N, and carry with them the bolts, Fig. 17, whose inclined planes acting on the edges 20 of the recesses *c, c, c, c*, in the frames O, O, project the bolts towards the wheels I, I, which bolts are quickly brought in contact with the horns of the catches L, and both the horns of the catches and the bolts being inclined planes, the bolts will pass on and depress the catches, upsetting the tumblers, and the springs taking on the opposite sides will drive down the points of 25 the catches between the teeth of the wheels I, I, raising the opposite limbs which were down before, and this in whatever part of the circle the catches happen to be, which will be apparent by observing the horns of the catches L, and the Figure of the projected parts of the inclined planes; and as soon as the wheels N, N, have traversed a quarter of a circle, their bolts will fall 30 into the recesses in the frames O, O; it is understood they must be turned in the opposite direction to what the motion of K was before. The steam being let on the piston, the shaft will then revolve in the reverse direction to what it did before; these operations are almost instantaneously performed. The method of depressing the one limb of the catch by the wheels N, N, by their pinions 35 and the frames O, O, will be understood from the Drawing, as one method of reversing the motion; but I do not consider myself as bound always to employ it, but at liberty to use any other if more convenient. The machine, Figure 1, is intended to be used with this as well as with common reciprocating engines,

FIG. 2.

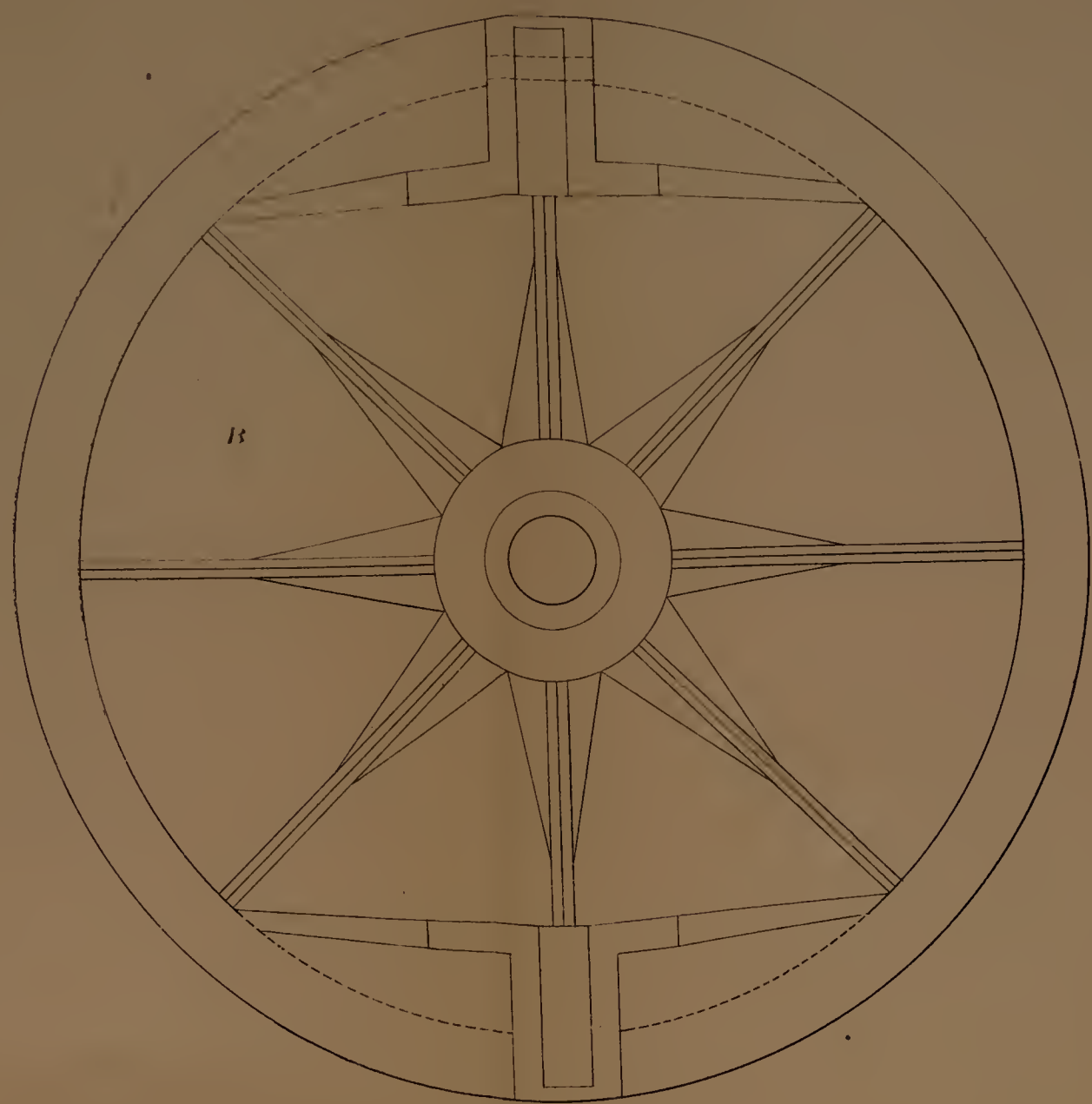
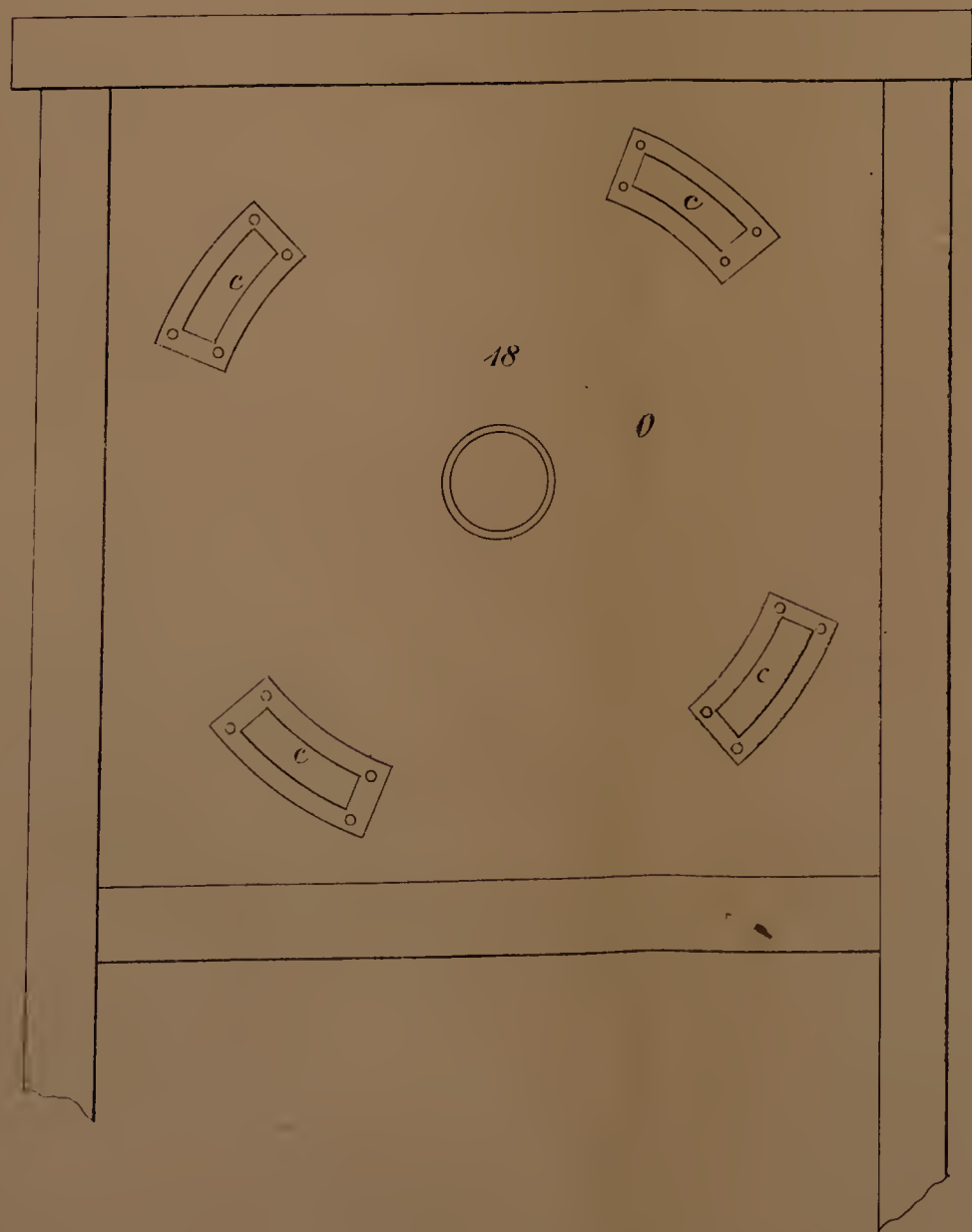
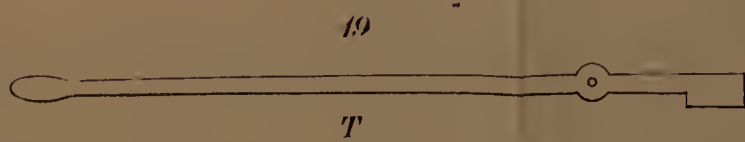
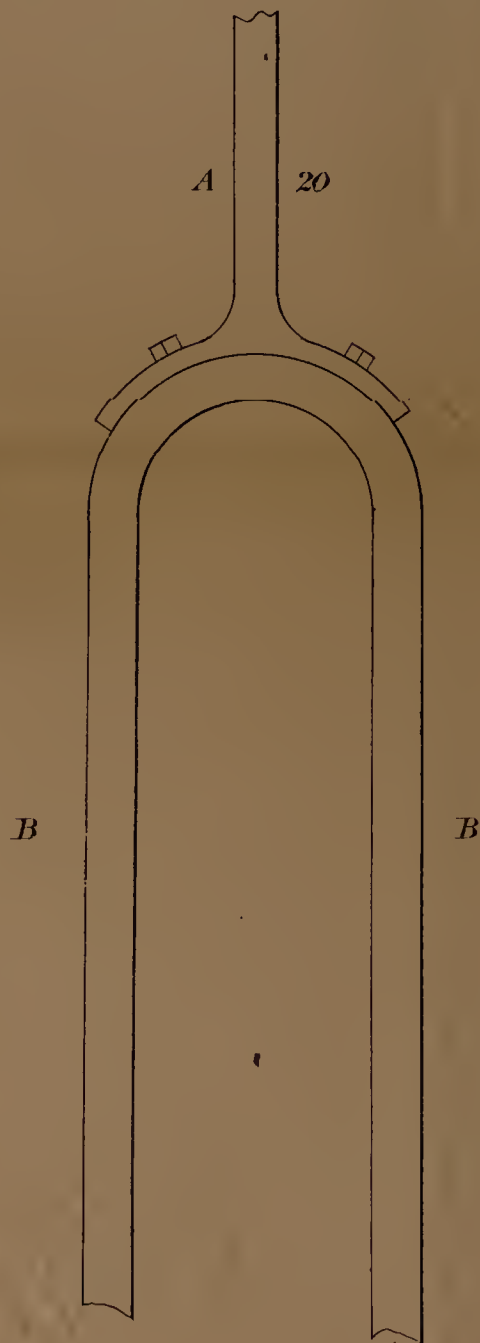
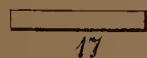
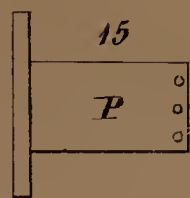
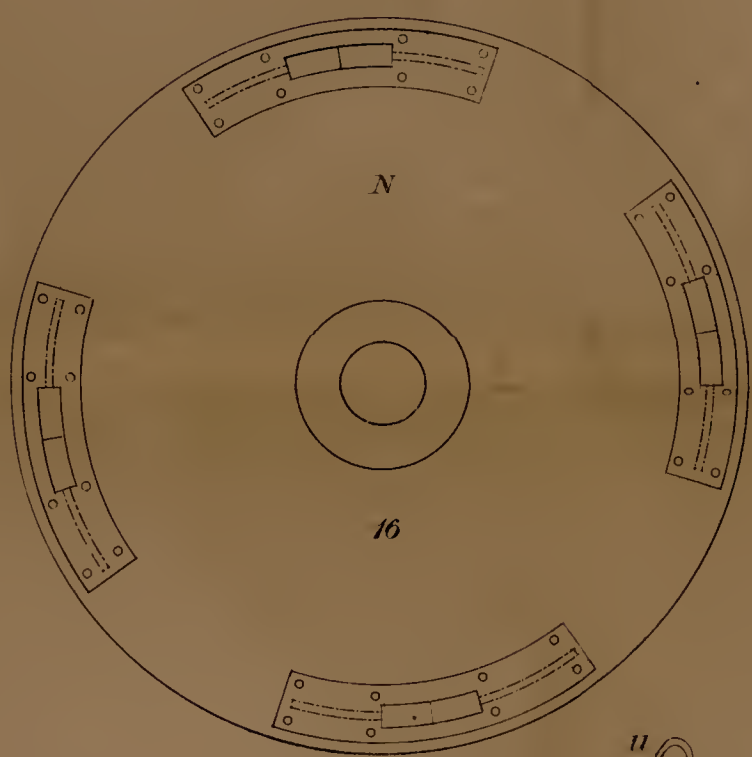
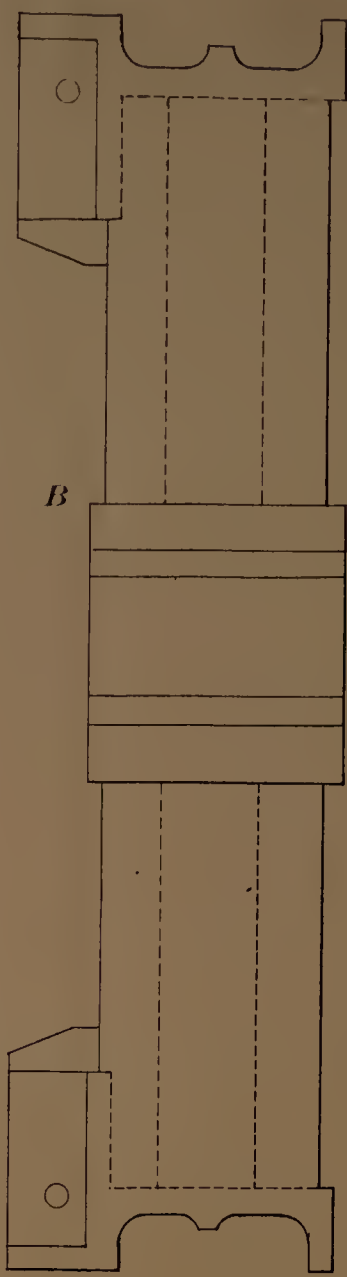


FIG. 3.



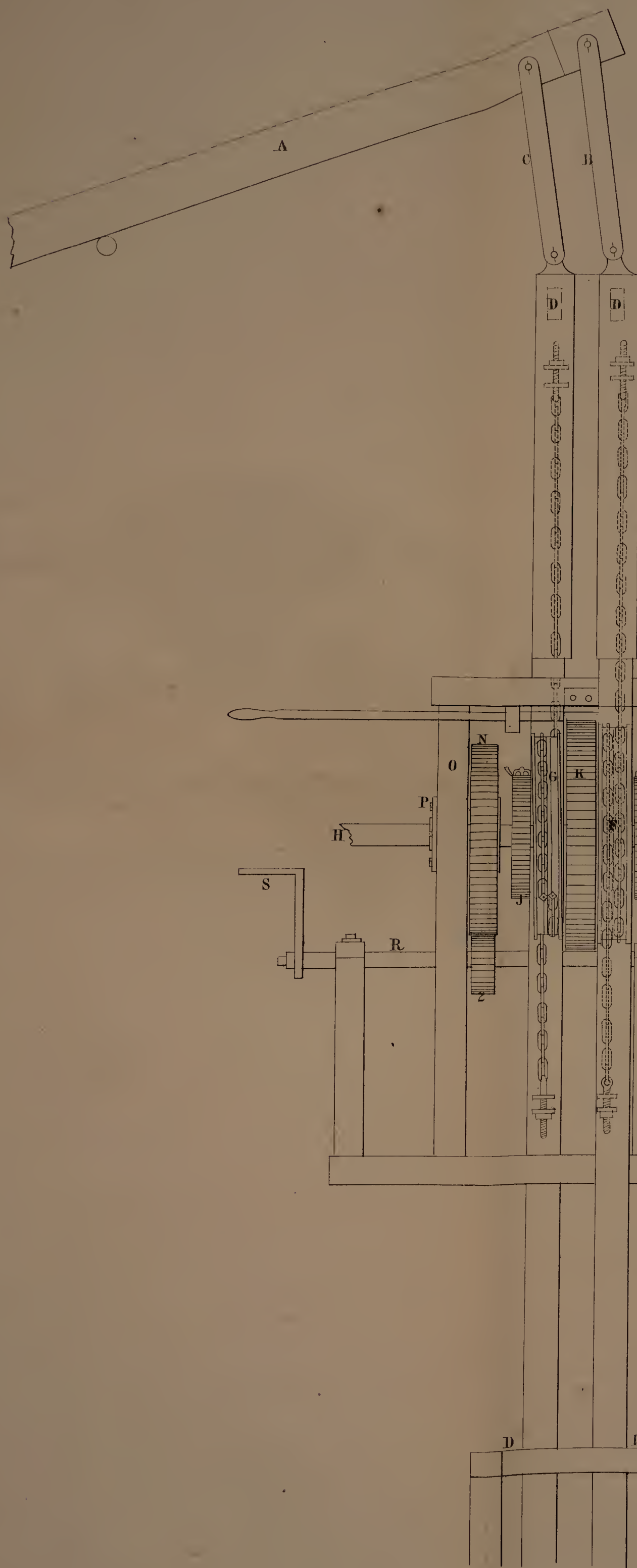


FIG. 13.

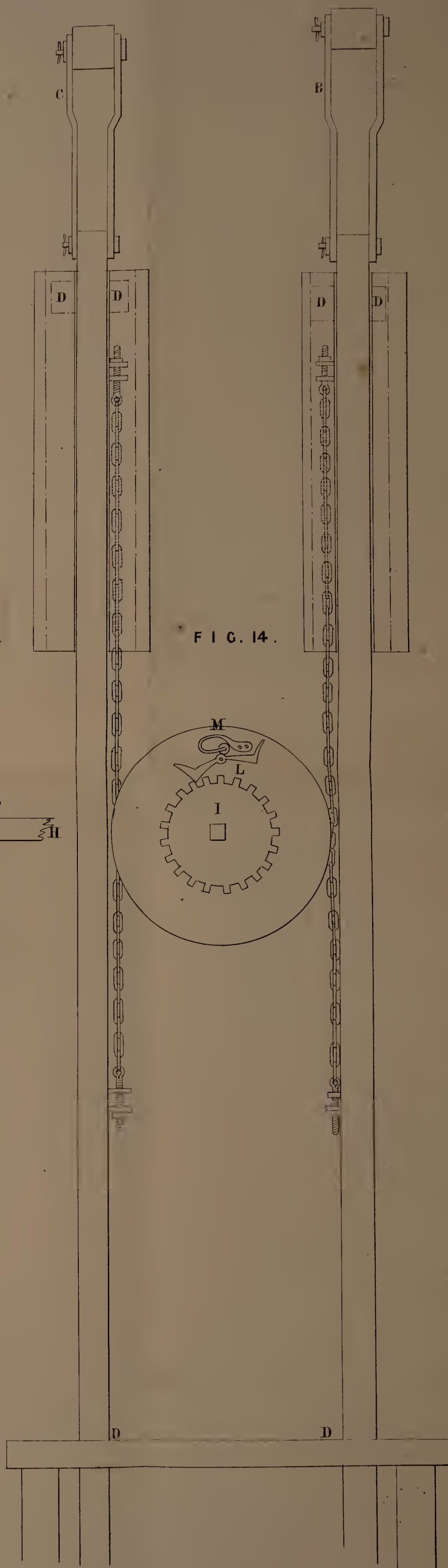


FIG. 14.

The enrolled drawing is partly colored

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by having a third rod fixed on a centre placed between the two limbs of the beam A, and the machine may be applied on a shaft some distance below it. The machine, Figure 13, 14, may also be used horizontally, and without a beam, by connecting the chains to Fig. 20, where A represents the piston rod, 5 and B, B, the limbs to connect the chains; these limbs are intended to be wide enough to admit of the chains acting in a right line on both of the wheels F and G, and these limbs are kept in a rectilineal direction by the usual means of slides and grooves, and if Figure 1 is used it will be applied over it. Holes are bored through the periphery, and through to the centres of 10 the wheels, which revolve on the shaft to supply them with oil; and I must remark that, as well as using the lever T, or a bolt for the purpose of stopping the motion of the machine by acting on the teeth or spokes of the wheel K, either may be made to have the same effect by being brought to act on any other wheel or segment of a wheel, or arms fixed on the shaft for that purpose, 15 or by pallets brought to bear on any such wheel or segments, or arms, by being turned on a lever or otherwise, so as to prevent the weight which is raised on the shaft from carrying it backwards and endangering the machinery, when the catches are in the act of reversing the motion, and before the opposite ends have taken in the teeth of the wheels I, I.

20 My next improvement applies to the kibbles of a steam whim or other machinery of that kind, and consists in fixing a similar rope to that by which the kibble is hauled up to the ring at its bottom, and extending it down the shaft, and attaching it to the bottom of the other kibble, but so long as not to affect the lower kibble by the action of landing the stuff out of the upper one, 25 the two kibbles having the rope which connects their handles passed with sufficient rounds to give steadiness on the barrel, which may be fixed on the shaft of the rotary machine last mentioned (and with which Fig^r may be connected), will be ballanced; and if a strong hook is suspended by a rope at the mouth of the shaft, and a ring is placed on the rope at the bottom of each 30 kibble, but at a sufficient distance to admit the kibble to be drawn up to the whim sheave, which carries the rope to the rotary engine, and when the kibble is drawn to that height the hook at the shaft's mouth is fixed in the ring before mentioned; the motion of the rotary being reversed, the kibble will descend, and sufficient slack rope will be given to admit of its being unloaded without 35 difficulty, when the motion of the machine should be again reversed, and the kibble again brought up to the whim sheave, so as to tighten the rope; the hook may then be removed, the motion of the machine again reversed, and the kibble lowered away; and the one rope and kibble will so completely balance the other kibble and rope, that, except from the shaft up to the whim sheave,

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the engine will only have to lift the contents of the kibble then below it; besides, the kibbles will be kept steady, and not be liable to be dashed about, which they often are, to the great injury and expence of the adventurers in the mine, and particularly when the shafts underlie, or have an inclined direction; and in order that the miners may be able to draw their stuff from 5 lifts of different depths, the ropes may be made divisible by means of shackles placed at such distances, similar to the method by which Mr. Acraman shortens his patent cables, and at the different lifts hooks should be placed suspended as before mentioned at the mouth of the shaft, and rings on the ropes at proper distances from the hooks to hold by, and by such means little difficulty will be 10 experienced in the use of this method.

In witness whereof, I, the said Henry Penneck, have to these Presents (written or engrossed on three skins of parchment, each being first duly stamped) set my hand and seal, this Twenty-first day of August, One thousand eight hundred and twenty-one. 15

HENRY (L.S.) PENNECK.

EDMONDS, Extra.

AND BE IT REMEMBERED, that on the Twenty-first day of August, in the year of our Lord 1821, the aforesaid Henry Penneck came before our said Lord the King in His Chancery, and acknowledged the Specification aforesaid, and all and everything therein contained and specified, in form above written. 20 And also the Specification aforesaid was stamped according to the tenor of the Statute made for that purpose.

Inrolled the Twenty-fourth day of August, in the year of our Lord One thousand eight hundred and twenty-one.

LONDON :

Printed by GEORGE EDWARD EYRE and WILLIAM SPOTTISWOODE,
Printers to the Queen's most Excellent Majesty. 1854.